Woodward-Clyde Consultants

STATUS REPORT ON LEAK INVESTIGATION AT TANKS 19T AND 20T AT DOUGLAS AIRCRAFT COMPANY'S LOS ANGELES FACILITY

Prepared for:

Douglas Aircraft Company
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Prepared by:

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18 December 1986

STATUS REPORT ON LEAK INVESTIGATION AT TANKS 19T AND 20T AT DOUGLAS AIRCRAFT COMPANY'S LOS ANGELES FACILITY

1.0 INTRODUCTION

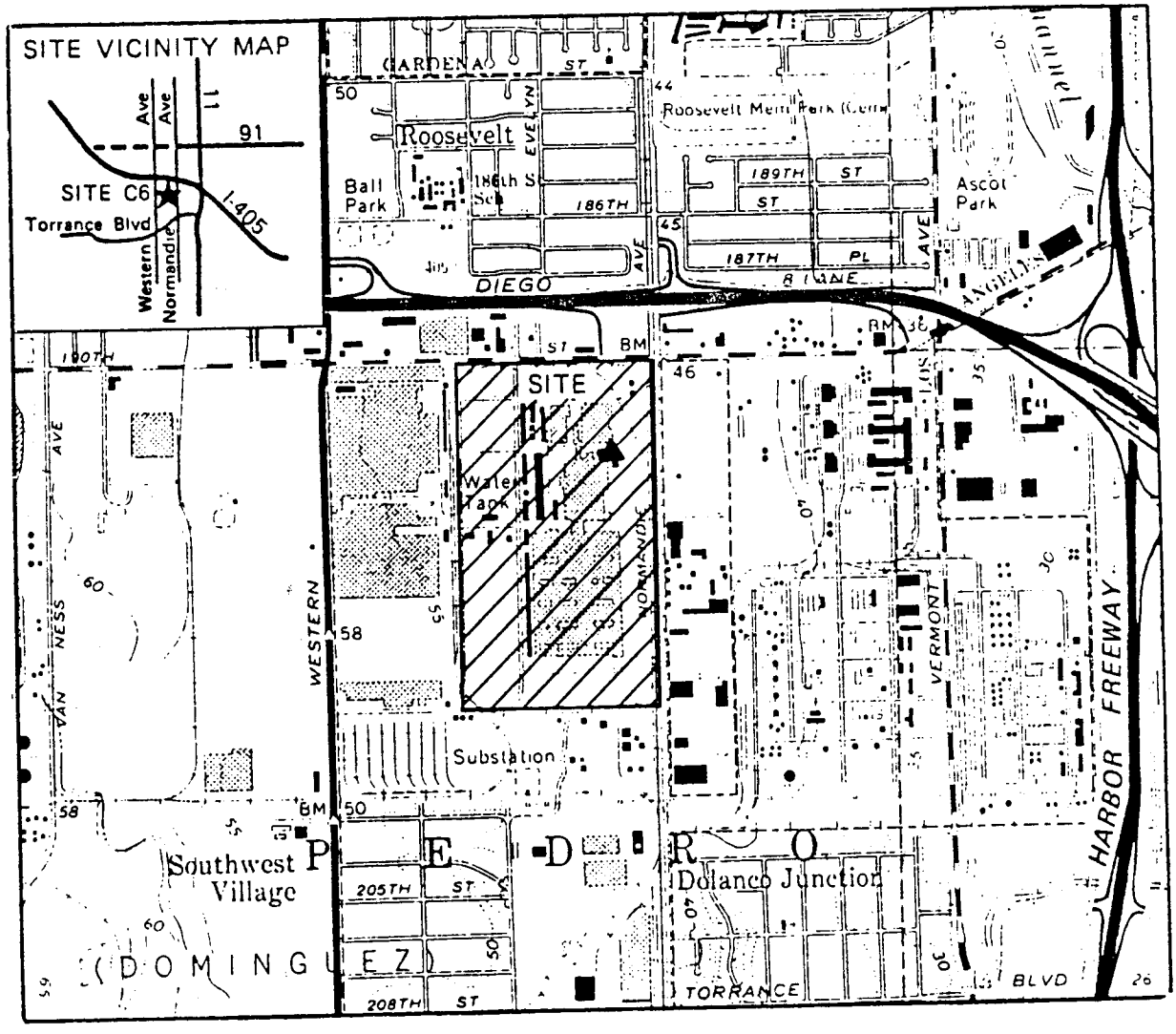
Woodward-Clyde Consultants was authorized by Douglas Aircraft Company (DAC) in April of 1986 to proceed with a leak investigation at DAC's C6 Facility in Los Angeles. A fuel oil leak had occurred from the underground piping associated with tanks 19T and 20T, and the objective of this investigation was to investigate the extent of leakage and to provide DAC with a report describing the lateral and vertical limits of soil contamination. A copy of the original work plan is presented in Attachment 1.

This report presents the results of the investigation to date, and identifies the work needed to complete this investigation.

2.0 FIELD WORK COMPLETED

On 4 April 1986, a boring (B-1) was drilled at the site to assess the vertical extent of contamination that may have occurred from the pipe leakage. The exact location of the pipe leak is not known, but it is believed to be somewhere along a north-south pipe run of approximately 10 to 15 feet within the building. The boring was installed approximately 30 feet east of the pipe run, and outside the building, because of access problems caused by the presence of underground piping.

The boring was drilled to a 50-foot depth with soil samples collected at 5-foot intervals beginning at the 3-foot depth. Soil samples were monitored in the field for the



C6 FACILITY

N

0 1000 2000 3000 Feet

Scale

▲ Approximate Location of Tanks 19T and 20T

Project: DOUGLAS AIRCRAFT CO. Project No. 41863A	FACILITY LOCATION MAP	Fig. 1

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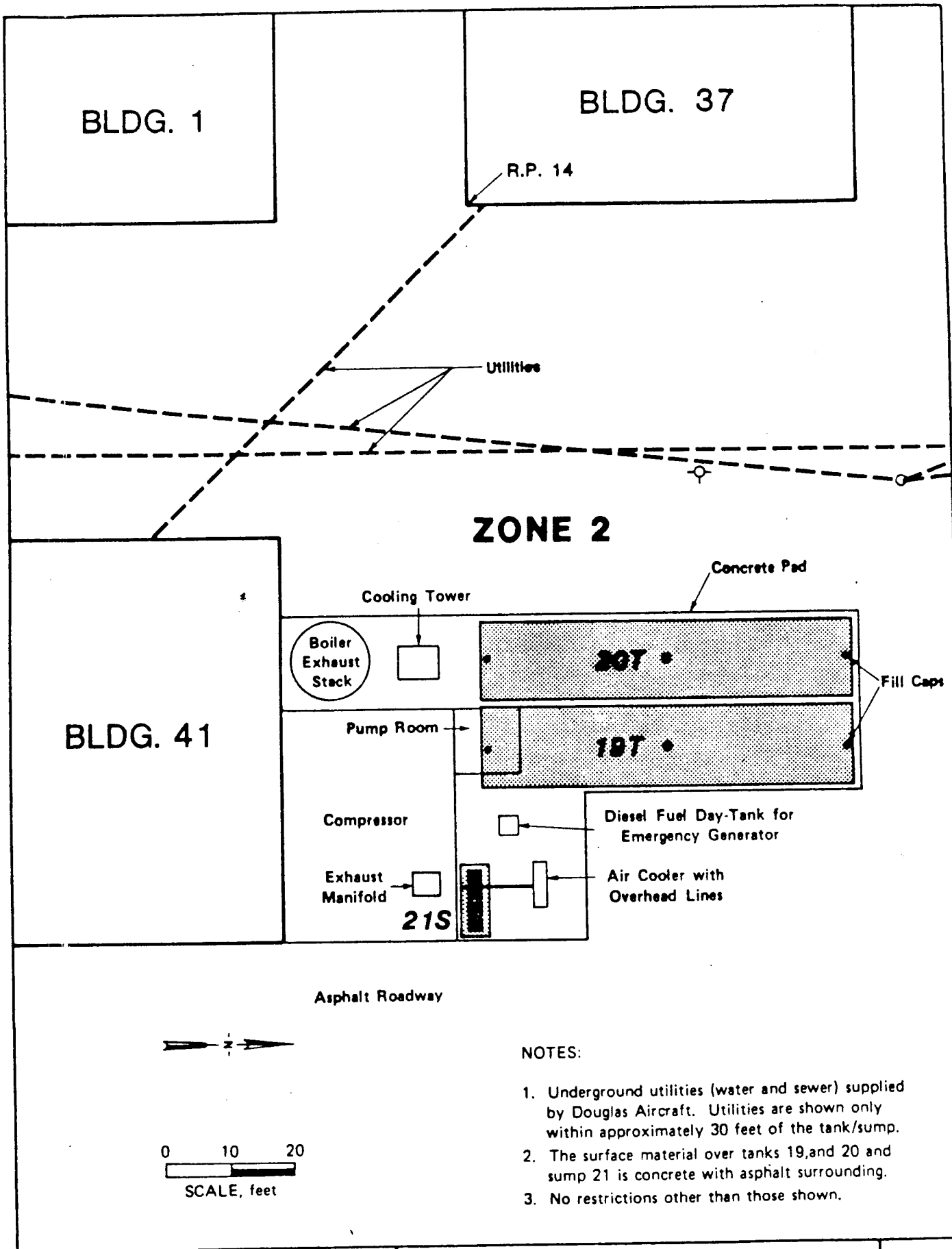

NOTES:

1. Underground utilities (water and sewer) supplied by Douglas Aircraft. Utilities are shown only within approximately 30 feet of the tank/sump.
2. The surface material over tanks 19,and 20 and sump 21 is concrete with asphalt surrounding.
3. No restrictions other than those shown.

Project: DOUGLAS AIRCRAFT CO. Project No. 41863A	LOCATION MAP FOR TANKS 19T AND 20T AND SUMP 21S	Fig. 2

WOODWARD–CLYDE CONSULTANTS

presence of volatile organics using an Organic Vapor Analyzer (OVA). The boring log for this boring is presented in Figures 3 and 4, which also show the soil headspace OVA readings at locations where samples were collected. One soil sample per 5-foot interval was analyzed for total petroleum hydrocarbons; the analytical results are attached in Attachment 2.

No significant hydrocarbon contamination was found in this initial boring, although slightly elevated levels were encountered at the 8 and 18 foot depths. Because of the inability to place this boring closer to the source and apparent lack of lateral contaminant spreading, the vertical extent of contamination has not been defined at this time.

3.0 ACTIVITIES TO BE COMPLETED

The boring drilled in Task 1 served to help delineate the lateral spread of contamination as described in the original work plan under Task 2. In order to acquire data on the vertical extent of contamination at the suspected source of the leak, Woodward-Clyde proposes to utilize a Simco 2400 drill rig inside the building. This rig is limited to depths of approximately 40 feet. This boring (B-2) will be sampled at 5-foot intervals. Field and laboratory assessment of soil contamination will be conducted in the same manner as for Boring B-1.

Because of the depth limitations of the Simco drill rig, the question of vertical extent of contamination may remain after the installation of this boring at the source. For this reason, Woodward-Clyde proposes two options to assess the contaminant extent after the source boring has been

completed. The first applies if the vertical extent of contamination has been delineated by the source boring, and the second applies if it has not.

If the contamination has remained within the top 40 feet of the unsaturated zone, the lateral extent will be further evaluated as discussed in Task 2A of the original work plan. One additional boring will be drilled outside the building as close to the source as possible. If contamination is not present in the groundwater, the volume of soil affected will be calculated based on the concentration gradient of petroleum hydrocarbons in the soil borings, the estimated volume of product lost and the lithology of the area.

Should contamination be present at the bottom of the source boring (Boring B-2), Woodward-Clyde proposes to drill to groundwater at a location immediately adjacent to the building, as near to the contaminant source as possible. Soil samples will be collected at 5-foot intervals and analyzed in the laboratory for total petroleum hydrocarbons. A 4-inch groundwater observation well will be installed, developed and sampled, and the water sample analyzed for total petroleum hydrocarbons. Should groundwater contamination be found, the investigation will proceed as outlined in Task 2C of the original work plan with the installation of up to three additional monitoring wells. If contamination is not present in the groundwater, the volume of soil affected will be calculated based on the concentration gradient of petroleum hydrocarbons in the soil borings, the estimated volume of product lost and the lithology of the area.

4.0 ESTIMATED SCHEDULE

Woodward-Clyde estimates that, if no groundwater observation wells are required, the remaining field work can be completed by December 31st, with a report submitted to Douglas by January 15, 1987.

ATTACHMENT 1

ORIGINAL WORK PLAN FOR LEAK INVESTIGATION

BORING LOCATION: Tanks T-19 and T-20		ELEVATION AND DATUM	
DRILLING AGENCY: Datum Exploration	DRILLER: Keith	DATE STARTED: 4 April 1986	DATE FINISHED: 4 April 1986
DRILLING EQUIPMENT: Mobile B-53, 9 5 Hollow Stem Auger		COMPLETION DEPTH (FT): 50	ROCK DEPTH (FT): –
DIAMETER AND TYPE OF WELL CASING: None Installed		NO. OF SAMPLES: DIST: –	UNDIST: 10 CORE:
TYPE OF PERFORATION: Not Applicable		WATER DEPTH (FT): FIRST –	COMPL.: 24 HRS –
TYPE OF PERFORATION BACKFILL: No. 60 Sand (85%) / Bentonite Flour (15%)		LOGGED BY: M. Leach	CHECKED BY:
TYPE OF SEAL: Asphaltum			

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG: Lithology	OVA (ppm): Sample	OVA (ppm): Backgn'd	SAMPLES: No.	SAMPLES: Type	SAMPLES: Blow Count	SAMPLES: Drilling Rate/Time	REMARKS
	Aspalt								
	Rust colored, SILTY SAND (SM)								
	Medium stiff, moist, dark brown, SANDY CLAY		0.0		1	X	6 4 3		
5	Becomes very moist								
			30		2	X	15 22 35		
10	Becoming light reddish brown and hard								
			34		3	X	6 12 16		
15	Becoming light brown and very stiff								
	Medium dense, moist, light brown, CLAYEY, fine grained SAND (SC)		100		4	X	11 8 13		
20	Becoming lighter brown and drier								
			50		5	X	8 16 18		
25	Very stiff, moist, light brown, SANDY CLAY (CL)								
			45		6	X	8 15 30		
30	Very stiff, moist, light brown, CLAY (CL)								
	Very dense, light grayish-brown, fine-grained SAND (SP)		4		7	X	9 27 50 (4")		
35									

Project: DOUGLAS TORRANCE Project No.: 41863A	LOG OF BORING	Fig. 3

LA/OR-0783-235R

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BOE-C6-0070729

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG: Lithology	OVA (ppm): Sample	OVA (ppm): Backgn'd	SAMPLES: No	SAMPLES: Type	SAMPLES: Blow Count	SAMPLES: Drilling Rate/Time	REMARKS
40				7	8	X	14 24 36		
	Moist, light brown, CLAY (CL) with some fine-grained SAND								
	Dense, brownish-gray, SILTY, fine-grained SAND (SM)			5	9	X	12 17 30		
45	Hard, moist, brown CLAY (CL)								
	Very dense, gray, fine-grained SAND (SP)			18	10	X	13 22 34		
50	Bottom of Boring at 50 feet								
55									
60									
65									
70									
75									
80									

Project: DOUGLAS TORRANCE
Project No.: 41863A

CONT. LOG OF BORING

Fig. 4

LA/OR-0783-236R

WOODWARD – CLYDE CONSULTANTS

WORK PLAN TO EVALUATE THE EXTENT OF CONTAMINATION FROM PIPE LEAKAGE NEAR TANKS 19T AND 20T AT DOUGLAS AIRCRAFT COMPANY C6 FACILITY LOS ANGELES, CALIFORNIA

Prepared for:

Douglas Aircraft Corporation
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Long Beach, California 90846

Prepared by:

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203 North Golden Circle Drive
Santa Ana, California 92705
(714) 835-6886

31 January 1986
Project No.: 41863A

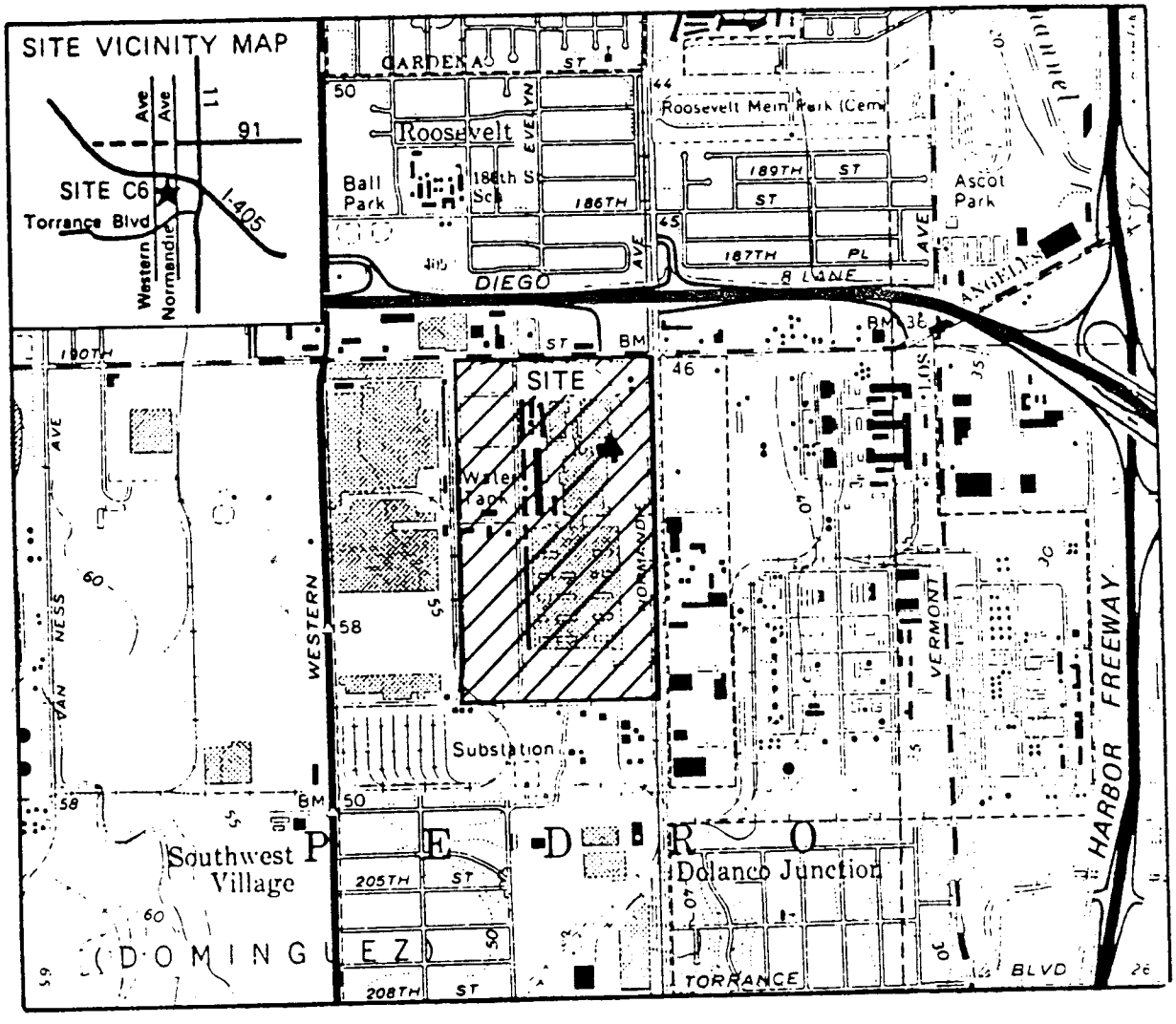
WORK PLAN
TO EVALUATE THE EXTENT OF CONTAMINATION FROM PIPE LEAKAGE NEAR TANKS 19T AND 20T DOUGLAS AIRCRAFT COMPANY C6 FACILITY LOS ANGELES, CALIFORNIA

1.0 INTRODUCTION

Douglas Aircraft Company (DAC) has reported a fuel oil leak from the underground piping associated with tanks 19T and 20T at the C6 facility in Los Angeles. The City of Los Angeles has requested that DAC investigate the extent of the leakage and provide a report describing the lateral and vertical limits of soil contamination. This work plan presents Woodward-Clyde Consultant's (WCC) recommended approach to conducting the investigation. The approach is based on data and information presented in the Phase 1 Leak Detection and Management Program (LDMP) report for the C6 facility. Relevant information from the LDMP is summarized herein.

2.0 SITE CONDITIONS

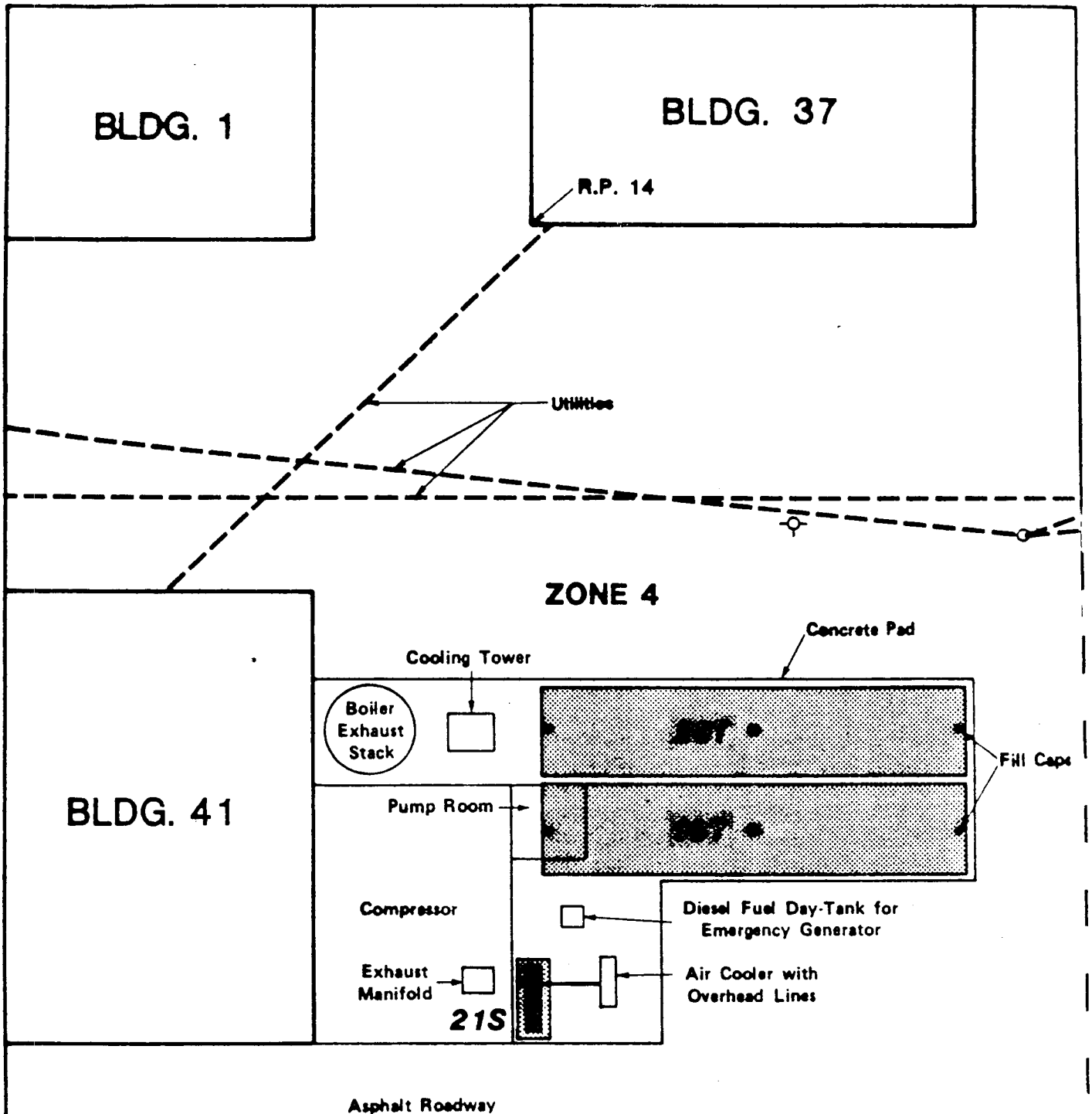
The DAC C6 facility in Los Angeles is a fabrication support facility for the DAC Long Beach manufacturing plant. The facility location is shown in Figure 1. The general location of underground tanks 19T and 20T on the facility is indicated in Figure 1, with more detail provided in Figure 2. Tanks 19T and 20T are steel tanks of 50,000 gallons capacity each, which are used to store fuel oil.



C6 FACILITY

Project: DOUGLAS AIRCRAFT CO. Project No. 41863A	FACILITY LOCATION MAP	Fig. 1

WOODWARD–CLYDE CONSULTANTS



NOTES:

1. Underground utilities (water and sewer) supplied by Douglas Aircraft. Utilities are shown only within approximately 30 feet of the tank/sump.
2. The surface material over tanks 19,and 20 and sump 21 is concrete with asphalt surrounding.
3. No restrictions other than those shown.

Project: DOUGLAS AIRCRAFT CO. Project No. 41863A	LOCATION MAP FOR TANKS 19T AND 20T	Fig. 2

WOODWARD–CLYDE CONSULTANTS

The results of the work conducted for the LDMP show that the facility is underlain by alluvial deposits of silty clay grading to sand within 15 to 25 feet of the surface.

Perched groundwater is thought to exist at approximately an 60 to 70-foot depth. As reported in the LDMP, this perched groundwater is not used for domestic or industrial purposes, being of poor quality. This zone of perched groundwater is underlain by the Bellflower aquiclude (aquitard), which is of substantial thickness. The shallowest aquifer used for water supply purposes in the vicinity of the site (the "200-foot sand") lies at a depth of approximately 125 feet.

3.0 SCOPE OF WORK

To meet the objective of evaluating the lateral and vertical extent of contamination present, WCC proposes to conduct a phased investigation in two tasks. The first task will consist of an initial evaluation of the likely vertical extent of contamination through a review of site hydrogeology, lithology, and spill documentation, followed by a single boring close to the source. The second task will be implemented to assess the lateral distribution of contamination. The approach to conducting the second task is described in terms of several options depending on whether or not contamination of groundwater is indicated by the Task 1 boring.

Task 1 - Assess Vertical Extent of Contamination

Data available from previously completed geotechnical borings, exploratory borings, and monitoring wells will be reviewed to obtain a better understanding of the subsurface

lithology. The nature of the spill and observations made during piping repair activities will be reviewed to develop an estimate of the location and amount of diesel fuel leaked. Based on site lithology, spill documentation, and the ability to place a well close to the source, a single boring will be drilled to assess the vertical extent of contamination.

The boring will be drilled with a 10-inch hollow stem auger. The completion depth will depend upon a field evaluation of contamination, which will be made by measuring soil sample organic vapor headspace with an organic vapor meter (OVM). Soil samples will be obtained at five-foot intervals, beginning at a depth of three-feet, using a Modified California Sampler. The boring will continue until no indications of soil contamination are observed, or to a maximum depth of 50 feet. Should soil contamination still be present at 50 feet, the boring will be grouted, and Task 2 implemented. This will be done to minimize the possibility of vertical transport of contaminants into the groundwater via the boring. One sample from every five-foot interval where contamination is believed to exist, based on OVM headspace readings, will be sent to a certified laboratory for testing for total extractable petroleum hydrocarbons (IR) EPA Method 418.1 (modified).

For the purposes of developing a scope of work and budget, it has been assumed that contamination has reached a perched layer of groundwater, which is thought to exist at a depth of approximately 60 feet (based on available information on groundwater depths at the site).

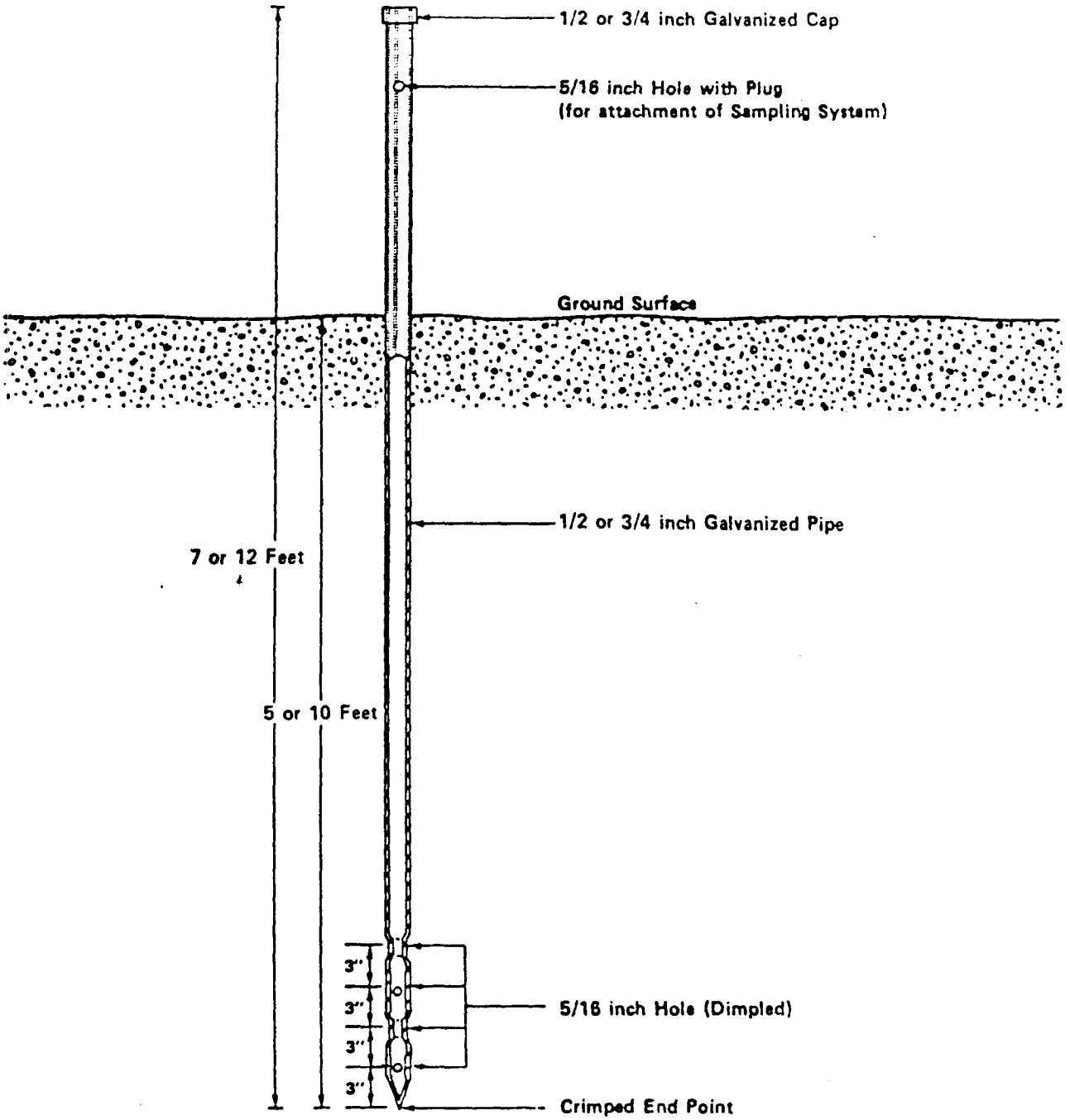
Prior to any drilling activity at the site, available drawing showing the location of utilities and other underground elements in the vicinity of tanks 19T and 20T will be obtained from DAC and reviewed. Underground Service Alert of California will also be contacted for information on utilities in the area. The procedures to be used for soil sampling, drilling, and decontamination are presented in Appendix A.

All soils and groundwater removed during the field investigation will be placed in 55 gallon drums and appropriately labelled by WCC personnel. Douglas will provide the 55-gallon drums which must be clean or new. Subsequent transport, handling, storage, and disposal of these wastes will be the responsibility of Douglas Aircraft Company. WCC will assist Douglas with management of these residuals if so requested by Douglas.

Upon completion of the Task 1 investigation, WCC personnel will meet with DAC to discuss the results. WCC envisions that a meeting will then be held with regulatory officials and DAC, to discuss the Phase 1 results and the need for further investigations at the site.

Task 2 - Assess Horizontal Extent of Contamination

The specific course to be followed in Task 2 will be governed by the results of the vertical extent of contamination assessment (Task 1). Therefore, Task 2 is described here in terms of three alternatives, denoted as Tasks 2A, 2B, and 2C. Task 2A procedures will be followed if the results of the field investigation indicate that the contamination remains within the vadose (unsaturated soil) zone. Task 2B will be implemented if contamination has



Project: Project No.	SOIL GAS SAMPLING PROBE CONSTRUCTION	Fig. B.1

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The work plan includes the collection and analysis of gas samples at approximately 20 to 40 locations. As many as half of these locations may be resampled for GC analysis. The locations for collecting soil gas samples will be selected using a statistically based sampling plan. All available information will be utilized in developing this plan. After soil gas samples from 25 to 50 percent of the probes have been analyzed, the original sampling plan will be reevaluated using this additional data, and, if necessary, a revised sampling plan will be implemented.

The results of the soil gas survey will help to delineate the extent of shallow groundwater contamination at the site, and in the selection of locations for groundwater observation wells.

ATTACHMENT 2

ANALYTICAL DATA

ATTACHMENT 2

ANALYTICAL DATA

WCAS
WEST COAST
ANALYTICAL
SERVICE, INC.
ANALYTICAL CHEMISTS

WOODWARD & CLYDE
203 N. Golden Circle Dr.
Santa Ana, CA 92705

ATTN: ALLISTER CALENDER

April 14, 1986

Job Number 2822

LABORATORY REPORT

Samples: Twenty (20) soils
Date Received: 4/4/86
Purchase Order No.: Project 41863A

Ten (10) samples were analyzed for total petroleum hydrocarbons by EPA Method 418.1. The results are as follows:

Sample No.	Total Petroleum Hydrocarbon Parts per Million
1-1-3	15
1-2-3	155
1-3-3	19
1-4-3	63
1-5-3	16
1-6-3	13
1-7-3	24
1-8-3	18
1-9-3	16
1-10-3	25

Joe Bramblett
Laboratory Manager

D. J. Northington, Ph.D.
Technical Director

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1-10-3	25

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D. J. Northington, Ph.D.
Technical Director

reached the saturated zone (water table) and soil gas measurements (see Appendix A) can be used to assist in plume delineation. Task 2C will be implemented if soil gas monitoring is not viable at this site. Soil gas monitoring is sometimes not a useful tool in detecting contamination due to diesel. However, because soil gas monitoring is a rapid and relatively inexpensive method of mapping contaminant plumes, its usefulness at this site will be evaluated prior to installation of observation wells. The minimum savings that should accrue if soil gas mapping is viable are illustrated by the differences in estimated costs between Tasks 2B and 2C. It should be noted that the eventual savings may be greater than those shown, because it is likely that more than four wells will be required in Task 2C.

Task 2A: If contamination has remained within the unsaturated zone, an estimate of the lateral extent of contamination will be made based on lithology, volume of product lost, and the variation of soil hydrocarbon concentrations as a function of depth. From this information calculations will be made to estimate the degree of plume spreading that could have occurred. The extent of spreading will then be tested by installation of two borings to a depth of approximately 50 feet.

Task 2B: If contamination may have reached groundwater as indicated by the results and Task 1, the evaluation of its lateral extent will be conducted on the basis of expected plume migration together with an investigation of soil hydrocarbon gases found in the unsaturated zone above the plume (see Appendix B for a discussion of soil gas survey techniques).

The initial step in evaluating the lateral extent of contamination will be to assess the detectability of soil hydrocarbon gases emanating from the groundwater. Approximately 10 soil gas probes will be installed to a depth of 10 feet around the source of the leak. Soil gas sampling will be conducted using a low volume air pump attached to a perforated metal pipe probe. Soil gas samples will be drawn into an organic vapor analyzer (OVA). The data obtained will be used to assess detectability of soil gas emanating from the groundwater plume.

Based on the premise that the gases are detectable, the investigation will proceed as follows. One 4-inch groundwater observation well will be installed in the area where initial soil gas data indicate the presence of the plume. The well will be installed in the zone of the highest soil gas readings. Two additional well will be installed far enough from the others to allow estimation of the groundwater gradient. To do this, these three wells will be surveyed for elevation and distance in relation to appropriate structures. Static water levels in the three wells will be measured for elevation on two separate dates after well completion (to allow levels to stabilize). A second measurement of the static water levels will be necessary to verify results, which may have been anomalous due to groundwater pumping or recharge near the site. Based on the data obtained, the static water levels can be triangulated and water level contours drawn to estimate a groundwater gradient. Then by interpreting the spatial distribution of concentrations of constituents found in the groundwater, a probable zone of contamination can be estimated.

Task 2C:

If the soil gas investigation is unable to detect hydrocarbons in the soil gas, the following groundwater investigation will be implemented. Three 4-inch groundwater observation wells will be installed. These will be placed so that an estimate of the groundwater gradient can be made. All wells will be installed using the water well standards of the State of California presented in Bulletin 74-81. Based on the estimated gradient and water quality data, at least one additional observation well will be installed to provide further information on the nature and extent of the groundwater plume.

All groundwater observation wells installed will be constructed with a 4-inch diameter casing, and may be used as monitoring wells if such is warranted in the future. Soil samples will be monitored at five-foot intervals with an OVM, as in Task 1, to detect soil contamination. Those samples which yield elevated OVM readings will then be analyzed in the laboratory.

An attempt will then be made to estimate the extent of groundwater and soil contamination using the data obtained from the soil and groundwater samples and the direction of the hydraulic gradient.

If the groundwater is found to be impacted by diesel fuel, the extent of impact will also be modeled. The models to be used will depend upon what the investigation reveals with respect to whether free product is present, and the concentration distribution of soluble fractions (i.e., whether the source of contamination can be taken as a one

time pulse or a continuous liberation of soluble material from soil or free product).

If free product is found, the thickness and extent of free product can be estimated by contouring and through the use of various theories, e.g., the theory of Hantush (1968). The unsteady movement of a fresh water lense overlying a saline water body, with appropriate consideration for diesel fuel properties, has been used to estimate the thickness of free product. Other potential models would be reviewed to evaluate their appropriateness to the site specific problem. If soluble fractions of product are found in the groundwater estimates of extent and concentration can be made using Hunt (1978) if the concentration distribution based on wells appears as a pulse, or Domenico and Robbins (1985) if data indicates a continuous source. These later models are of an analytical nature but provide for three dimensional dispersion and are suited to estimating ranges of anticipated variations in properties of the aquifer. Simplified estimates of the extent and velocity of contaminant movement can also be made using average linear velocity calculations based on Darcy's law.

4.0 SUMMARY OF ESTIMATED SPILL INVESTIGATION COSTS

Task	Investigation Scenario	Cost
1	One boring with soil sampling every 5 feet to maximum depth of 50 feet	$16,180

2A	No GW contamination; estimate amount of soil contaminated based on Task 1 and available data, installation of two additional soil borings	$ 8,200
2B	GW contamination; extent of contamination delineated with soil gas and three wells	$37,900
2C	GW contamination; minimum of four wells to groundwater for plume delineation	$40,590

It should be noted that the need for Tasks 2B and 2C depends on whether or not contamination has reached groundwater. Task 1 costs include the preparation of a Phase 1 report and a meeting with regulators to discuss the need for additional work. Task 2A will only be implemented if there is no evidence of groundwater contamination, and will entail development of an estimate of the amount of contaminated soil, based on data and information obtained in Task 1 in addition to that collected during Task 2A.

Soil gas sampling will be used in Task 2B to delineate the contaminant plume, assuming that contamination has reached groundwater. Results of the soil gas survey will optimize placement of monitoring wells and may reduce the number of borings needed to estimate the plume. Task 2C does not utilize soil gas sampling and depends only on borings and observation wells to delineate the plume.

These costs are estimates, and the overall cost of the investigation could range from $25,000 to $57,000, depending on the extent of contamination.

Costs presented do not include the following:

- Cost of drums for storage of residuals
- Disposal costs for the residuals should they be contaminated.

References

Domenico, P.A. and Robbins, G.A., 1985, A New Method of Contaminant Plume Analysis. Groundwater, v. 23, No. 4, pp. 476-485.

Hantush, M.S., 1968, Unsteady Movement of Fresh Water in Thick Unconfined Saline Aquifers. Bull. Internat. Assoc. Sci. Hydrology. v. 13, No. 2, pp. 40-60.

Hunt, B., 1978, Dispersive Sources in Uniform Groundwater Flow. J. Hydraul. Div., Proc. Am. Soc. Civ. Eng. v. 104, pp. 75-85.

APPENDIX A
Field Operations

A.1 DRILLING OPERATIONS

The drilling operation will consist of drilling borings and collecting soil samples at three locations at the Douglas Aircraft facility in Los Angeles. Drilling will be performed by California Testing Laboratories, Inc. Drilling will be performed with a Mobile B-61 drill rig using an 8-inch outside diameter (O.D.) hollow stem auger. Descriptions of soil types, sampling depths, and the volatile organic compound readings will be recorded on boring logs.

The concentration of volatile organic compounds will be monitored during drilling using an organic vapor meter (OVM).

A.2 SOIL SAMPLING

Soil samples will be collected to provide information on subsurface stratigraphic conditions and for laboratory analysis. In general, sample descriptions will be prepared from visual examination of the samples and cuttings obtained during the drilling operations. Soil sampling will be performed with a two-inch I.D. modified California Sampler (containing four brass tubes four inches long and two inches in diameter). The sampler will be driven at the respective sampling depth by dropping a 140-pound hammer approximately 30 inches. The number of blows (blow counts) required to advance the sampler will be recorded on the field log.

After taking the soil sample, the brass tubes will be extruded on a portable field stand. The brass tubes will be sealed with aluminum foil, PVC end caps, and electrical tape. The brass tubes will then be stored in a portable ice chest cooled to a temperature of approximately 4°C using ice. Samples will be delivered to the laboratory for testing. Chain-of-custody procedures, including the use of daily field reports, sample identification labels, and chain-of-custody forms, will be used for tracking the collection and shipment of the samples.

A.3 EQUIPMENT DECONTAMINATION

Augers will be steam cleaned between each boring. Sampling equipment will be cleaned between each use, using the following general procedures:

1. Tap water rinse, brush assisted if necessary, to remove dirt;
2. Tap water wash with detergent (Liqui-Nox);
3. Rinse with hexane;
4. Rinse with methanol, if necessary;
5. Rinse with deionized water;
6. Air dry.

The brass tubes in the modified California Sampler will be cleaned in the Woodward-Clyde Consultants' laboratory using the procedures described above. The tubes and PVC end caps will be packed in plastic bags prior to use at the site.

A.4 HEALTH AND SAFETY PROCEDURES

Prior to commencement of field work on Phase I of this project, a Health and Safety plan was developed by the Woodward-Clyde Consultants' corporate health and safety officer. The health and safety plan is in the project files of both Woodward-Clyde Consultants and Douglas Aircraft Corporation.

As a part of the health and safety plan, the protective clothing and equipment available for use by field personnel will include:

1. Tyvek coveralls;
2. Chemical resistant gloves;
3. Safety goggles or glasses;
4. Steel-toed rubber boots;
5. Hard hats; and
6. Half-face respirators with organic vapor cartridges.

Gloves, steel-toed boots, and hard hats will be routinely worn by personnel involved in the drilling operations and Tyvek coveralls and goggles will be available. Respirators will be used only if volatile organic vapor concentrations exceed levels specified in the Health and Safety Plan (5 ppm).

An organic vapor analyzer will be used to monitor volatile organic vapor concentrations from the borings during drilling operations. The OVA will be set so that an audible

alarm would sound if concentrations greater than 5 ppm above ambient levels are detected. The OVA will be calibrated every day prior to drilling.

A.5 BORING ABANDONMENT

Following the conclusion of soil sample collection, borings will be abandoned in place. Abandonment procedures will include pouring a 4 to 1 mixture of very fine sand (#60) and bentonite flour into each boring until it reached a depth of approximately eight inches from the ground surface. The upper eight inches of the boring will be filled with mortar mix and leveled off with a trowel.

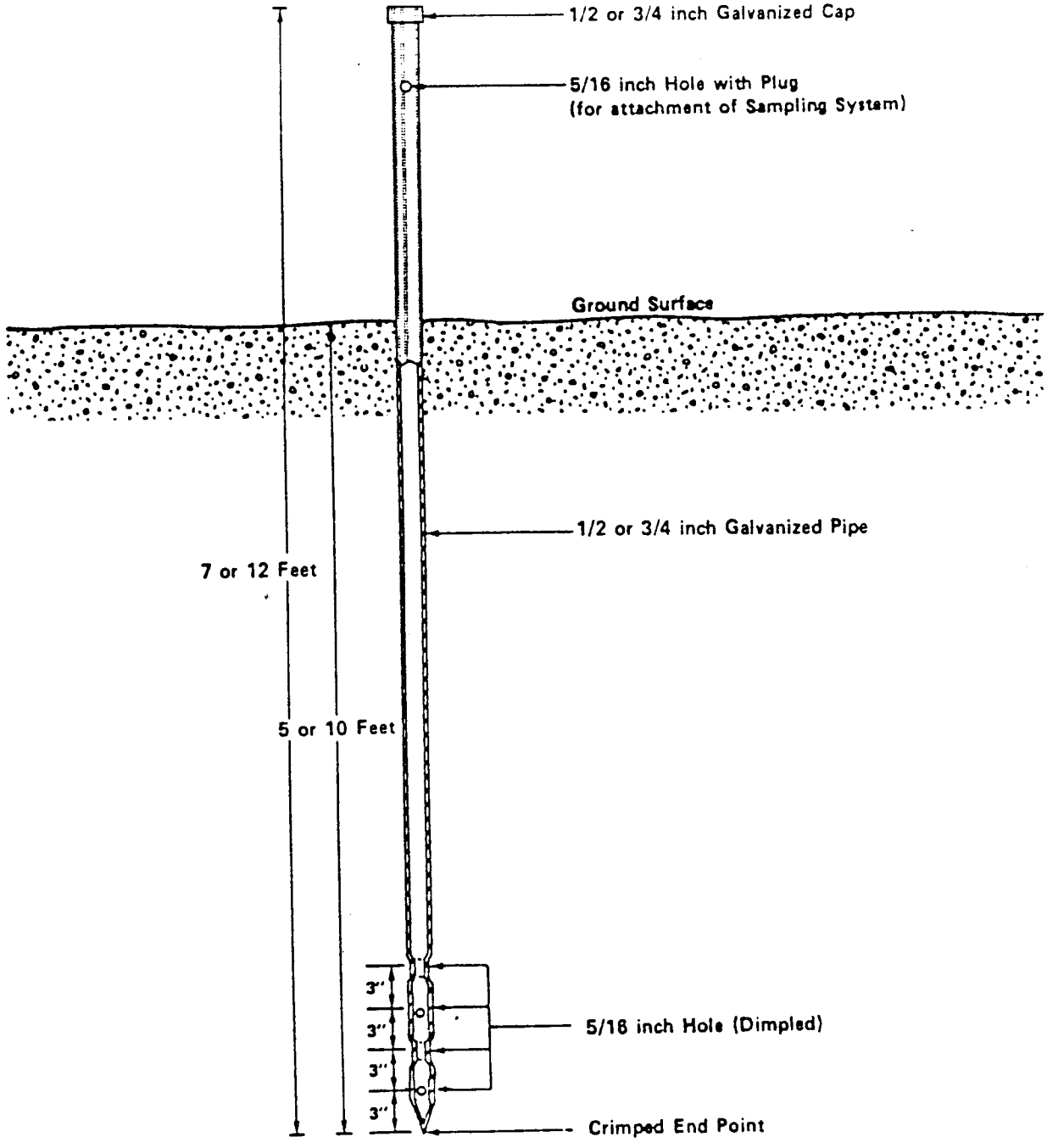
APPENDIX B

SOIL GAS INVESTIGATION

Work conducted by WCC and others has indicated that volatile organic compound (VOC) contamination of soil and shallow groundwater can be quickly evaluated by collecting soil gas samples for analysis using a soil vapor probe. The extent of VOC contamination of groundwater has also been evaluated by WCC using a combination of sampling and analysis of soil gases collected from above the groundwater plume and the installation of monitoring wells.

The procedure for conducting the soil gas sampling involves the insertion of a steel probe into the soil, usually to depths of 5 or 10 feet and drawing a sample of soil gas through perforations at the base of the probe with an oil-less vacuum pump (See Figure B.1). The soil gas samples are then analyzed using an organic vapor analyzer and/or a gas chromatograph.

In this study, field analysis of soil gas will be performed using a phased approach. The initial phase will focus on the gross presence of volatile organics as measured with an Organic Vapor Analyzer (OVA). Based on the plume defined, a number of those probes that fall within the region of the apparent plume will be resampled and analyzed using a gas chromatograph (GC). With this instrument, specific constituents can be identified and concentration contours drawn to evaluate the distribution of contaminants in the shallow groundwater and/or soil.



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The work plan includes the collection and analysis of gas samples at approximately 20 to 40 locations. As many as half of these locations may be resampled for GC analysis. The locations for collecting soil gas samples will be selected using a statistically based sampling plan. All available information will be utilized in developing this plan. After soil gas samples from 25 to 50 percent of the probes have been analyzed, the original sampling plan will be reevaluated using this additional data, and, if necessary, a revised sampling plan will be implemented.

The results of the soil gas survey will help to delineate the extent of shallow groundwater contamination at the site, and in the selection of locations for groundwater observation wells.